VOLTAGE SAG MITIGATION USING DYNAMIC VOLTAGE RESTORER WITH MULTI-FEEDBACK CONTROL

by

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This thesis is submitted to the department of Electrical Engineering in partial fulfillment of the requirement for the Degree of Master of Engineering

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2005

Abstract

Voltage sag is one of the most serious power problems that the industrial customers are facing nowadays. Voltage sag is a momentary reduction of rms voltage.

These momentary reductions are, sometimes, sufficient to cause tripping of sensitive equipment of an industrial installation. One such tripping can cause production loss worth of several hundred thousands to few millions of rupees depending on the nature of the industry (e.g. Glass industry).

Voltage sags can be remedied at 'system-level' as well as 'device-level'. The system level solutions are costly because controlling the voltage sag events of a power system involves large amount of money and effort. On the other-hand, every customer. fed by a power system is not affected by voltage sags. Only few customers have sensitive equipment such as process controllers- which need protection from sags. Therefore a device-level solution provided at the customers' doorstep is more attractive in economic terms.

Dynamic Voltage Restorer (DVR) is one of such 'device-level' mitigating devices that could be used to protect a customer from voltage sags. The basic theory behind the DVR is the series voltage compensation. In case of a sag of the incoming supply voltage to a customer installation, the DVR injects the balance of voltage in series with the incoming voltage so that the load does not see any abnormal condition.

Since a sag continues within a few fractions of a second, the DVR has to respond fast enough to compensate the sag. Therefore, the control method adopted in the DVR has a vital role in its satisfactory performance.

In this research project, three different control options, namely open-loop control system, close-loop control system and multi-feed back control system were designed,

analysed and digitally simulated. This thesis contains the details of those design, analysis and simulation.

Out of the three control options, the multi-feed back controlled DVR has shown superior performance compared with the other two options and therefore, this option is recommended for practical use in protecting an important load. From the analysis and also the digital simulations, it has been proved that the multi-feed back controlled DVR is capable of protecting any load up to 5 MVA (power factor from 0.6 to unity) against system voltage sags.